

REMARKS

Reconsideration and allowance of the present application based on the following remarks are respectfully requested.

Claims 1-12 are pending in the application.

Claim 1 has been amended.

Claims 13-26 have been cancelled.

The Examiner has indicated an error in the form PTO-1449 submitted with an IDS for this application on March 21, 2000. A corrected form PTO-1449 is included with the filing of this Amendment.

Claims 1-12 and 25 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Loopstra (USPN 6,208,407). Applicants respectfully traverse this rejection.

Loopstra et al. disclose a lithographic projection apparatus with a measurement station for determining the height of a substrate, as a function of position within the plane of the substrate, relative to a reference plane 170 of the substrate holder. Interferometers (100, 150) are used for height measurements of both the reference plane 170 and selected portions of the substrate surface, with relative heights stored in memory. The substrate is then transferred to a position where it may be exposed and processed. Another interferometer present at the exposure position monitors the height of the reference plane 170 during processing of the substrate, and using the relative heights stored in memory, optimizing adjustments to the substrate position are made based on the portion of the substrate being exposed.

Newly amended claim 1 of the present invention discloses a height mapping system which measures the heights of portions of a substrate held on a substrate holder relative to a physical reference surface. This is supported, for example, on page 10, lines 10-21 of the specification. The disclosed physical reference surface differs from the reference plane 170 disclosed by Loopstra and is not obvious therefrom.

Claim 1, thus, is patentable over Loopstra. Claims 2-12 depend from claim 1, and are, therefore, also patentable over Loopstra.

The rejection of claim 25 is moot as claim 25 has been cancelled.

Applicants, therefore, respectfully request that the rejection of claims 1-12 under 35 U.S.C. § 102(e) be withdrawn.

Claim 25 has been rejected under 35 U.S.C. § 102(b) as being anticipated by Loopstra et al. (WO 99/28790), Nielson et al. (US 2001/0013936), Sakamoto et al. (USPN 4,999,669), Ota (USPN 5,416,562), and Ebinuma (USPN 5,917,580).

All of the rejections of claim 25 under 35 U.S.C. § 102(b) are moot as claim 25 has been cancelled.

Claims 1-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Loopstra et al. (WO 99/28790) in view of Loopstra et al. (USPN 5,969,441). Applicant respectfully traverses this rejection.

The process disclosed by Loopstra requires two independent interferometric measurements of the reference plane 170, making it necessary to accurately know the positional relationship between the two interferometers which measure the height of the reference plane 170 at the measurement station and during exposure of the substrate, respectively. This is, in general, a difficult task, and may cause drift.

In order to overcome this drawback, the present invention introduces a physical reference surface that has a position that does not vary substantially in time. The surface height of the substrate as well as position of the substrate table is measured relative to said surface. As this relationship does not vary as the substrate table is moved from the measurement station to the exposure station, inaccuracies caused by drift of the height mapping system are cancelled out, thus increasing reliability and accuracy. This feature is not taught or suggested by Loopstra. One skilled in the art could, therefore, not arrive at the present invention as recited in claim 1.

Claim 1, thus, is patentable over Loopstra. Claims 2-12 depend from claim 1, and are, therefore, also patentable over Loopstra.

Applicants, therefore, respectfully request that the rejection of claims 1-12 under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, the claims are now believed to be in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, please contact the undersigned at the telephone number listed below.

Attached is a marked-up version of the changes made to the claims by the current amendment. The attached Appendix is captioned "Version with markings to show changes made".

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,
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Enclosure: Appendix

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 is amended as follows:

1. (Twice Amended) A lithographic projection apparatus comprising:
a radiation system for supplying a projection beam of radiation;
a first object table provided with a mask holder for holding a mask;
a second, movable object table provided with a substrate holder for holding a substrate
and having a physical reference surface fixed thereto;

a projection system for imaging an irradiated portion of the mask onto a target portion
of the substrate;

a positioning system for moving said second object table between an exposure station,
at which said projection system can image said mask portion onto said substrate, and a
measurement station;

a height mapping system located at said measurement station and constructed and
arranged to measure heights, relative to said physical reference surface, of a plurality of points
on a surface of a substrate held on said substrate holder and to measure a position of said
second object table in a first direction substantially perpendicular to said surface of the
substrate, and to create a height map thereof;

a position measuring system located at said exposure station for measuring a position
of said physical reference surface in a first direction substantially perpendicular to said
substrate surface, after movement of said second object table to said exposure station; and

a position controller constructed and arranged to control the position of said second
object table in at least said first direction, during exposure of said target portion, in
accordance with said height map and said position measured by said position measuring
system [means].

End of Appendix